MultiLine Faxmodem
Owner's Manual

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Introducing MultiLine

MultiLine includes up to eight hot-swappable faxmodem modules in a single desktop unit. Each module is a Rockwell-based V.34 or 14.4/voice faxmodem with 14.4 Class 1 and 2 fax capability, FLASH memory, configuration-protection and DTR-reset jumpers, Caller ID, V.42, V.42bis, MNP® 2–5, MNP 10EC™, NVRAM, and lightning protection.

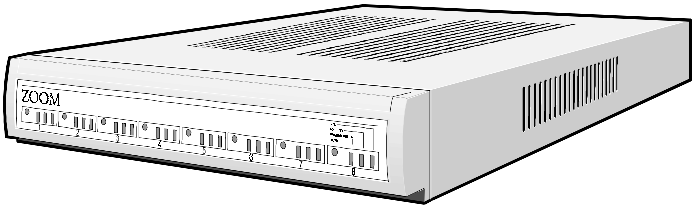


Figure 1. MultiLine

The front panel features a reset button and three status lights for each module. Standard telephone cables with RJ-11 jacks are provided for each module. There are optional cable kits with computer-to-faxmodem CCITT V.24 (EIA-232-D) serial cables, each with an RJ-45 male connector on one end. The other end has an RJ-45, DB-9, or DB-25 connector, depending on which cable kit is used.

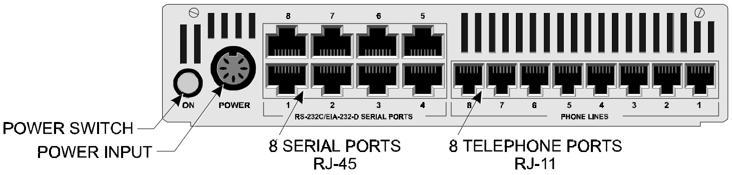


Figure 2. Rear View

MultiLine is an integrated and space-saving solution to your dialup WAN connectivity needs. You can use the faxmodems both as send-and-receive fax devices and as data modems. In this way you can communicate with fax machines, faxmodems, and data modems anywhere in the world. The compact design is ideal for use with DigiBoard PC/Xe™ and other multiport serial I/O devices, as well as remote access LAN devices including products from Shiva and other manufacturers.

MultiLine operates with most fax and data communications software. Since MultiLine is compatible with the standard AT command set, you also can use AT commands to control your faxmodem modules.

Owner's Manual Organization

This manual is organized as follows:

Introduction (this section) lists what you need to use the faxmodem.

Chapter 1 explains how to install the faxmodem and install additional modules at a later time.

Chapter 2 provides reference material on the features of the modules and using the faxmodem.

Chapter 3 provides information to help you if you have problems.

The Appendixes provide additional information about product features, specifications, FCC rules, and Canadian DOC. It also contains a summary of the AT command set and S registers.

Follow the instructions provided with your fax and data communications software to install the programs and to send and receive faxes and data.

Documentation Conventions

Commands and command examples described in this guide are in bold sanserif type. For example: To reset the faxmodem, type **ATZ** and press Enter.

Occasionally, there are spaces between commands to make a command line easier to read. You can type the command line with or without spaces between commands as long as the command line does not exceed 40 characters and spaces.

"**0**" in a command line indicates the number zero, not the letter "O".

What You Need to Use Your MultiLine

Make sure that you have received the following items in addition to this user's guide:

- Your MultiLine with 4 or 8 modules.
- A power supply and power cord.
- An accessory kit containing a bag of jumpers, a module removal tool, and telephone cables with RJ-11 connectors for each module.

If you have not received these items, or if any is damaged, please notify your dealer or supplier.

You also need:

- A multiport serial device such as a DigiBoard PC/Xe I/O board, a remote access device with multiple serial ports, or another communications device with serial ports.
- A computer-to-faxmodem CCITT V.24 (EIA-232-D) serial cable with an RJ-45 male connector for each module. See the section on cabling in Chapter 1 for more information. These also are available in optional cable kits.

1 Installation

This chapter explains how to install your faxmodem and additional modules.

- **Installing MultiLine** contains detailed installation instructions.
- **Cable Requirements** is necessary information for users or installers who make their own cables.
- The section on **Jumpers** shows you how to modify the factory configuration for the reset and security lock jumpers.
- **Installing and Removing Modules** describes the procedures for adding optional modules and removing any module.
- The final section of this chapter, **Optional Rackmount Installation**, describes how to install one or more MultiLine faxmodem units in a standard rackmount shelf.

CAUTION

Some components of MultiLine are sensitive to static electricity discharges. These discharges can cause damage. Use proper handling and grounding precautions whenever you handle modules or work with the cover removed.

Installing MultiLine

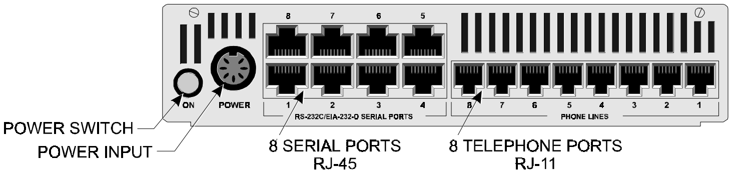


Figure 3. Rear View

Connecting MultiLine

When connecting cables, be sure to connect to the correct numbered ports.

1. **Connect the faxmodem-to-serial device cables (RJ-45).**

   Plug the RJ-45 end of each cable into the serial port connectors on the rear of the modem. Plug the other ends (RJ-45, DB-9, or DB-25 connectors) into the serial ports of the multiport device. See page 8 for a description of the pinouts if you are making your own cables.

2. **Connect the telephone cords (RJ-11).**

   Plug one end of each cord into the telephone ports on the rear of the unit. Connect the other end to a modular jack connected to a telephone line.

3. **Connect the power supply.**

   Plug one end of the power adapter into the jack on the rear of the unit marked POWER INPUT. Install one end of the power cord in the adapter and the other end into an available electrical outlet.

4. **Turn MultiLine on (by pushing the power switch on the back).**

   Each faxmodem module performs a brief self-test.

   After the self-test, the status lights show the faxmodems' current state. The **Present/Busy** light should be on, which shows the faxmodems are ready for use. (This light has two intensities: dim means that the module is ready; bright means that the modem is sending or receiving data.)

   If you haven't done so already, you now can install your communications software. Follow the instructions provided with the software.

Summary of the Indicator Lights

Figure 4 shows the location and arrangement of the reset button and indicator lights, and Table 1 describes the functions of the lights.

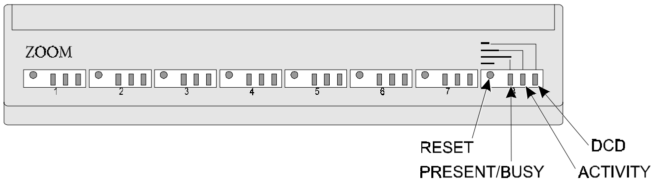


Figure 4. Front View

Light	Function	Description
Present /Busy	Modem Present (dim) or Busy (bright)	**Off:** No modem installed. **On**: Power is on. If dim, a module is installed and the power is on. If bright, the module is in use.
Activity	Transmit Data or Receive Data	**On**: Sending or receiving a byte of data to or from a remote modem. (At low transfer rates, the light blinks.)
DCD	Data Carrier Detect	**On**: The Carrier Detect signal from the faxmodem to the computer is on, indicating an active connection.

Table 1. Indicator Lights

Cable Requirements

Although cables for the faxmodem modules are easily obtained through retail electronics and telephone stores, some system installers may wish to make custom-length cables. Use the following illustrations as guidelines for most installations.

RJ-45 Faxmodem-to-Serial Device Cable

For standard DB-9 or DB-25 connections, we recommend adaptor blocks from 8-pin crossover RJ-45 cables. Table 2 (next page) shows the pinouts for the RJ-45, as shown in Figure 5 and Figure 6, and the pinouts for three commonly-used multiline serial boards.

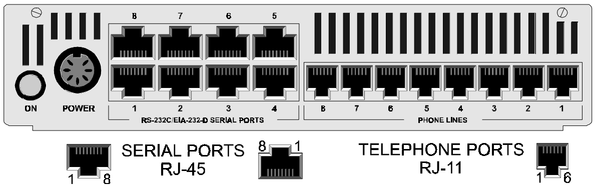
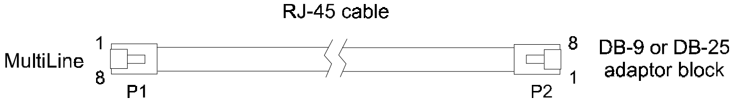


Figure 5. Pin Locations

MultiLine		**DigiBoard* PC/Xe**		**Equinox Megaport XP**		**US Robotics Modem Pool, Computone ValuePort**	
Pin #	Signal	Pin #	Signal	Pin #	Signal	Pin #	Signal
1	DTR	1	DCD	1	RTS	1	RI
2	CTS	2	RTS	2	DTR	2	DCD
3	SGND	3	GND	3	RXD	3	DTR
4	RXD	4	TXD	4	GND	4	SGND
5	TXD	5	RXD	5	TXD	5	RXD
6	GND	6	SGND	6	GND	6	TXD
7	RTS	7	CTS	7	DCD	7	CTS
8	DCD	8	DTR	8	CTS	8	RTS

Table 2. RJ-45 Pinouts



Wire Run List

P1	P2	Color	Signal
1	8	blu	DCD
2	7	org	RTS
3	6	blk	SGND
4	5	red	TxD
5	4	grn	RxD
6	3	yel	GND
7	2	brn	CTS
8	1	wht	DTR

Figure 6. RJ-45 Cable Pinouts for DigiBoard PC/Xe

NOTE: Like the DigiBoard RJ-45 interface, MultiLine does not support DSR (Data Set Ready) or RI (Ring Indicate):

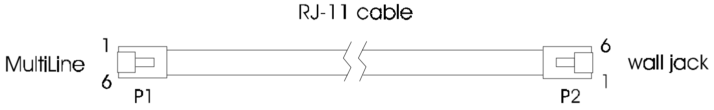
---

* Using 8-pin RJ-45 cabling for a DigiBoard requires that you enable the Alt Pin (or ALTPIN) feature in the device driver's setup. See your Digi documentation for more information.

- Some Bulletin Board System (BBS) software optionally look to the ring detect pin for incoming calls. Wildcat, for instance, has three choices: Ring Detect, Ring Result, or Auto Answer. Users of this software should configure it to use Ring Result or Auto Answer. Users of other software should check the software's documentation for similar workarounds.
- If your interface has a pinout for DSR, tie the DSR line to the MultiLine's DCD pin.

RJ-11 Faxmodem-to-walljack Cable

Note that although the crossover RJ-11 cable jack has six positions, only the middle four are populated.



Wire Run List

P1	P2	Color	Signal
1	6	n/a	
2	5	yel	
3	4	grn	tip
4	3	red	ring
5	2	blk	
6	1	n/a	

NOTE: The yellow and black wires also cross over, but carry no signal

Figure 7. RJ-11 Cable Pinouts

Jumpers

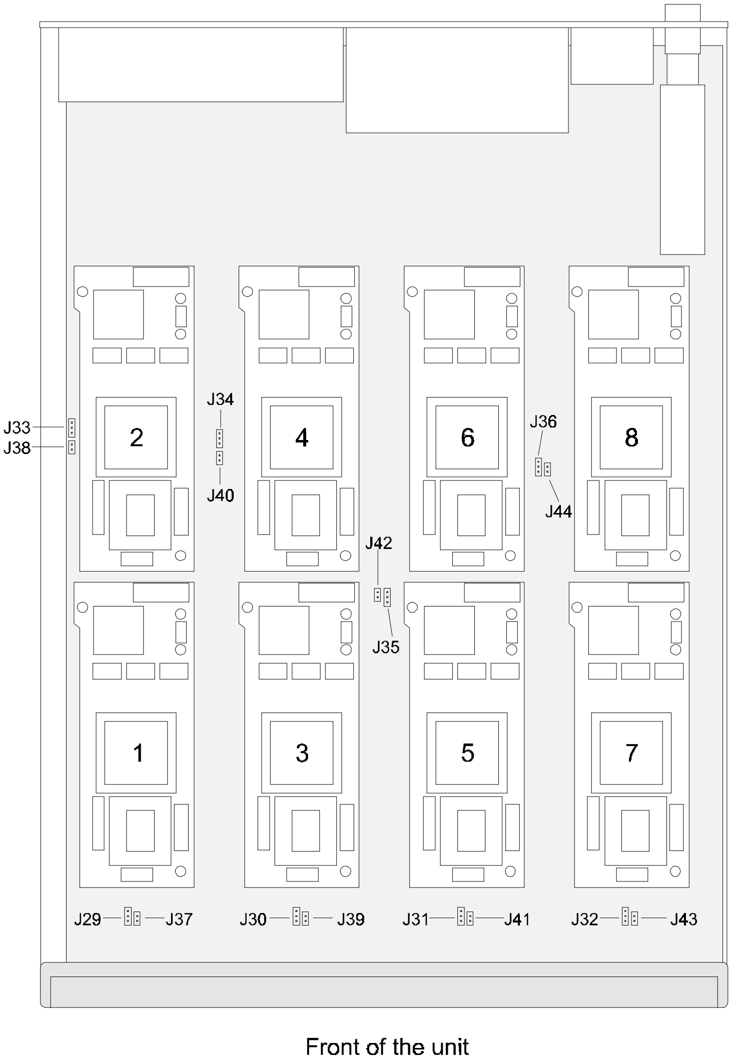


Figure 8. Jumper Locations

Reset Jumpers

The 3-pin jumpers (J29–J36), shown in Figures 8 and 9, control the Reset function.

In the first position (the pins toward the *rear* of the unit are jumpered), a module is reset only when:

- The Reset switch is depressed;
- The module receives a software reset command; or
- The power is cycled off and on.

In the second position (the pins toward the *front* of the unit are jumpered), a reset also occurs when DTR is asserted.

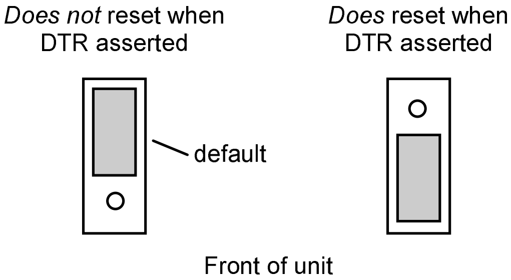

Does not reset when DTR asserted
Does reset when DTR asserted
default
Front of unit

Figure 9. Reset Jumpers

The default position is toward the rear of the unit.

NOTE: If you set the jumper to reset on DTR, you must store the current terminal speed and parity by issuing the AT&W command. If you fail to do this, the modem reverts to its default speed and parity after a reset. This means the modem cannot answer any calls until you issue an AT, since the ring message is output at the wrong speed.

Security Lock Jumper

The 2-pin jumpers (J37–J44), shown in Figures 8 and 10, control the configuration security lock. The lock prevents certain functions in the module's configuration from being changed.

When the jumper is in place, the security lock is engaged. When the jumper is removed, the lock is disengaged.

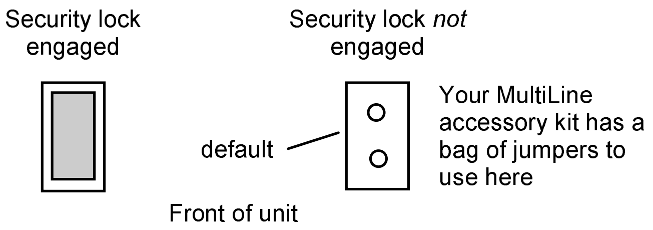

Security lock engaged
Security lock *not* engaged
default
Your MultiLine accessory kit has a bag of jumpers to use here
Front of unit

Figure 10. Security Lock Jumpers

There is a complete discussion of the security lock jumper in Chapter 2, Reference, beginning at page 23. The default position is with the security lock not engaged.

Installing and Removing Modules

The Zoom MultiLine contains "hot-swappable" modules that let you install and remove them (and their phone cables) without interrupting regular operation.

WARNING

Hazardous voltages may be present in MultiLine's chassis, which typically has phone line voltages as well as power supply voltages up to 24 VDC. While power is applied to the whole unit, only trained service personnel should perform the procedures described in this section. Trained service personnel are defined as persons trained in the technology of electrically-powered information processing and business equipment, and who are adequately aware of the hazards associated with this type of equipment. Opening the unit by unqualified personnel could result in personal injury or equipment damage, and could jeopardize your warranty and maintenance agreement.

This operation can be performed while the unit is on and other modems are operating. Make sure that the telephone line for the module to be replaced or installed is disconnected from the unit.

A MultiLine faxmodem unit containing four 14.4 or V.34 modules can be upgraded to a total of eight modems. You can install up to four more, one at a time or all at once, in any combination of speeds. Before installing a module, write down its serial number in your MultiLine Owner's Manual. The serial number is on a label on the top surface of the module.

Installation

To **install** a module, make sure there is no RJ-11 phone cable connected to the back of the MultiLine unit for the module being installed, then follow these steps:

1. **Unscrew the two Phillips-head screws at the back of the unit.**

   If the unit is rack mounted, slide the shelf out of the cabinet and unscrew the captive screws that hold the unit in place.

2. **Slide the cover off the chassis.**
3. **Orient the module so that the female 20-pin connector on the bottom of the module is toward the front of the chassis.**

   See Figure 11 for the locations of the connectors.

4. **Place the module over the locking guide pins.**
5. **Align the 20-pin connector and carefully press down on the front end of the module until the guide pin snaps into place.**
6. **Likewise, align the 2-pin connector on the bottom of the module and carefully press down on the rear until the guide pin snaps into place.**

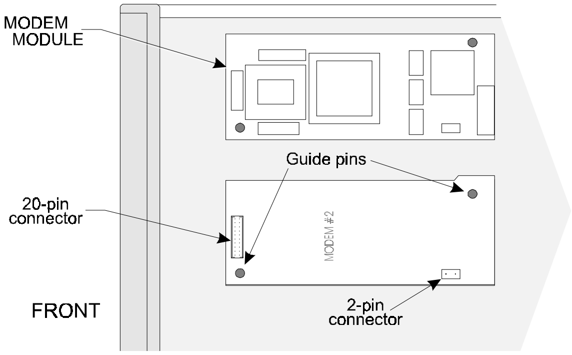


Figure 11. Installing a Module

7. **When you have finished installing modules, replace the cover.**

   Note that the metal base of the chassis engages guide slots in the cover.

8. **Replace the Phillips-head or captive screws.** Do not over-tighten the screws.

9. **Press the reset button** on the MultiLine front panel that corresponds to the modem number just installed.

Removal

To **remove** a module, follow steps 1 and 2 above; then:

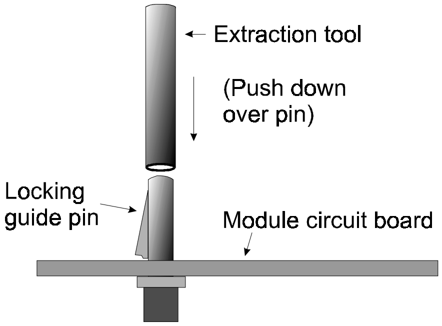


Figure 12. Removing a Module

1. **Push the nonconductive extraction tool over one of the locking guide pins until the tool is flush with the module.**
2. **Gently lift up on the edge of the module near the locking guide pin, taking care not to bend the pins in the 20-pin or 2-pin connector.**

   If necessary, use another nonconductive tool to pry the module up gently. Do not try to pry a module off without using the extraction tool.
3. **Repeat steps 1 and 2 at the other end of the module.**

Optional Rackmount Installation

You can mount two MultiLine faxmodems side-by-side in an optional shelf that fits a 19-inch rackmount. The shelf itself is 2U (3½ inches) high.

To install a MultiLine faxmodem in the shelf:

1. **Unscrew the two Phillips-head screws at the back of the unit.**

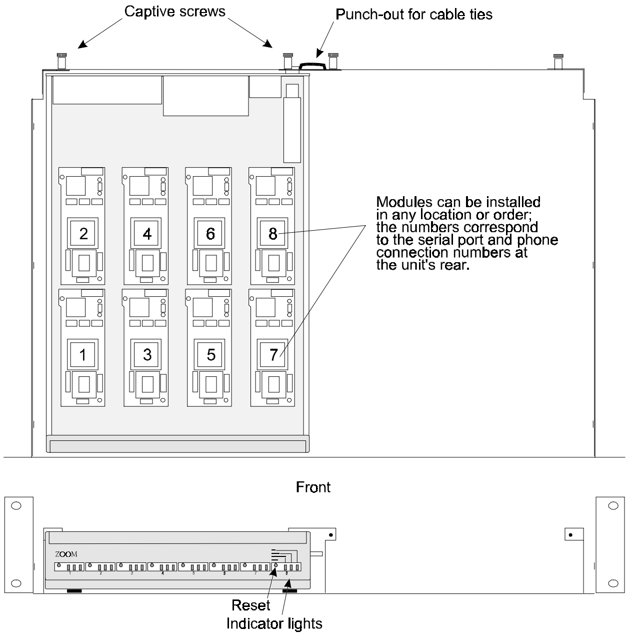

Captive screws
Punch-out for cable ties
2
4
6
8
1
3
5
7
Modules can be installed in any location or order; the numbers correspond to the serial port and phone connection numbers at the unit's rear.
Front
ZOOM
Reset
Indicator lights

Figure 13. Rackmount Installation

2. **Place MultiLine on the shelf.**

   Orient the chassis on the shelf as shown in Figure 13. Although the illustration shows the faxmodem chassis without its cover, MultiLine only screws in place with the cover on. We do not recommend leaving the cover off for extended periods.

3. **Tighten the captive screws to secure the chassis to the shelf.**

4. **Mount the shelf in a 19-inch rackmount cabinet, using the mounting hardware supplied in the kit.**

   For your convenience, there is a punch-out for attaching cables. See Figure 13 for the location of the punch-out.

2 Reference

This chapter contains detailed descriptions of the features of the 14.4 and V.34 modules. It also provides tips for setting up your fax and data communications software and using the faxmodem. See the heading "Tips for Selecting Setup Options" in the section "Customizing Faxmodem Settings" below.

Finally, there is a description of the jumper for locking each module's configuration settings.

After you set up your software, you are ready to start using your faxmodem.

Module Features

This table describes the features of the two module types and highlights their differences.

V.34 Module	V.32bis Module
Supports uncompressed data speeds up to 28,800 bps with the following modulation standards: V.34, V.FC, V.32bis, and slower protocols shown for the V.32bis module for maximum compatibility with installed modules.	Supports uncompressed data speeds up to 14,400 bps with the following modulation standards: V.32bis, V.32, V.22, V.22 A/B, V.23, V.21, Bell 212A, and Bell 103 protocols.
N/A	Voice storage and playback; tone detection/generation and call discrimination; DTMF (Dual Tone Modulation Frequency) tone detection and reporting. Enhanced ADPCM coding and decoding supports efficient digital storage of voice using 2-bits per sample or 4-bits per sample compression and decompression with a 7200Hz sample rate. Also supports 8-bit monophonic audio. These features are useful for digital telephone answering machine (TAM), voice annotation, faxback, and multiple voice mailbox services.
100% AT command set compatibility, with Extended MNP® 2–5, V.42, and V.42bis command set.	Same.

Fax: 14,400/12,000/9600/7200/ 4800/2400 Group 3, Class1 (EIA/TIA 578) and Class 2 (EIA/TIA).	Same.
Automatic adaptive equalization.	Same.
Automatic speed sensing — automatically adjusts to calling modem.	Same.
V.42bis and MNP5 data compression.	Same.
MNP10EC™ Enhanced Cellular Technology — for reliable cellular, international, and rural communications.	Same.
V.42-compliant error correction (LAPM and MNP2–MNP4).	Same.
V.17 protocol for 14,400 bps fax capability; also supports V.33, V.29, V.27ter, and V.21 channel 2.	Same.
Ability to manually force MNP4, MNP5, MNP10, V.42bis, and LAPM.	Same.
Auto-dial/Auto-answer.	Same.
Automatic negotiation of highest level of compression (V.42bis, MNP5) and error correction (V.42, MNP2–MNP4, MNP10EC) at speeds from 300 to 28,800 bps.	Same, at speeds from 300 to 14,400 bps.
Tone and pulse dialing, software-selectable.	Same.
Adaptive dialing, user-selectable.	Same.
Call progress tone decoding — busy, ring, and dialtone.	Same.
Line quality monitor and retrain capability.	Same.
Phone Directory (four 30-digit numbers stored in nonvolitile memory).	Same.
Three LED status lights per module, reporting present/busy, data carrier detect (DCD), and transmit/receive (activity); separate reset switch per module.	Same.
Advanced lightning and surge protection.	Same.

Caller ID capability (requires appropriate software and Caller ID service from your local phone company).	Same.
Nonvolitile configuration storage and locking in NVRAM.	Same.
Automatic EIA TR30.2 diagnostics and self-tests.	Same.
Automatic gain control.	Same.
Automatic terminal-to-modem speed sensing between 300 and 115,200 bps.	Automatic terminal-to-modem speed sensing between 300 and 57,600 bps.
Speed buffering/flow control.	Same.
Programmable inactivity timer (when set, hangs up if no data is received for 1–42 minutes).	Same.

Customizing Faxmodem Settings

Most software applications send an initialization string of AT command settings to the faxmodem as soon as you start up the software. The software determines which commands go into the initialization string based on the device you select during installation. If the commands are not disabled by the security jumper, they remain in effect throughout the communications session, unless the software sends other commands to override them or until the module automatically resets.

The software uses other AT commands and command strings for other purposes. For example, when you make a call from your faxmodem, the software inserts AT commands in a *dial string* with the phone number you are calling.

If necessary, you can add other AT commands to the strings as suggested in the section “Tips on Selecting Setup Options” below.

Appendix C contains a description of some common AT commands, S register values, and result codes.

Tips for Selecting Setup Options

In setting up your software, you may be asked to enter certain information. Most programs have default settings that are correct for use with this modem, and there is no need to change them. You should, however, check the following items:

- You may be asked to select the "modem type" from a menu. If you don't see this modem listed by name on the menu, select a **Hayes-compatible 14400 bps V.42bis modem** (either type of module) or a **Rockwell-based Voice modem** (V.32bis module only).
- In the dialing directory, **all entries should be set to 57,600 baud (V.32bis modules) or 115,200 baud (V.34 modules)**. All communications between the computer and the modem will take place at 57,600 or 115,200 bps, independent of the modem-to-modem speed. The faxmodem will auto-negotiate the highest speed connection between itself and the other modem.
- In the section of your software that may be called "Terminal Settings," make sure that **Hardware Flow Control (RTS/CTS) is ON (or Yes)**. This is necessary in order for V.42bis file transfers to work.
- Set **auto baud detect to OFF (or NO).**
- Finally, some programs ask **"Send init if CD high?", which should be set to YES**. Otherwise, the modem may not receive the proper initialization string.
- If your software suggests an initialization string for this faxmodem, you should use it. If this faxmodem is not listed by your software and no initialization string is suggested, use one of the following initialization strings:
- For PCs and compatibles: **AT &F**
- **NOTE:** If you are familiar with AT commands and you save any settings in the faxmodem's nonvolatile memory using the modem's **&W0 or W1** command, remove the **&F** from the initialization string. Otherwise, the contents of the initialization string will override the saved settings.

- If the software does not provide a dial string, use **ATDT**
- If your telephone service includes Call Waiting that you can temporarily suspend by pressing *70, use **ATDT*70,** as the dial string, followed by the telephone number. (**NOTE:** Be sure to type the comma). (For pulse dialing, use **ATDT1170,** as the dial string.) For more information about handling Call Waiting contact your telephone company.
- If your fax software gives you the option of selecting Class 1 or Class 2 fax drivers, select Class 2. The faxmodem supports both standards. However, Class 2 gives more control to the faxmodem, which generally results in faster fax communications.

While using your software and faxmodem you will rarely need to send AT commands directly to the faxmodem. However, if you need to enter AT commands you must do so from the software's terminal mode.

To use AT commands in terminal mode

1. Start your data communications program.
2. Change to terminal mode **(also called command, local, direct, or dumb mode)**.
3. Type in the AT command you need and press Enter.

When you finish, you can return to the data communications program's standard user interface. See the program's documentation if you need help.

To Return to the Factory Default Settings

- In terminal mode, type **AT &F** and press Enter.

Security Lock

The security lock feature lets you prevent a user from changing part or all of the modem's configuration. This feature is activated for a given module by placing a jumper on one of the jumper blocks J37 through J44, as described on page 12.

Specifically, the lock prevents the user from changing $$P commands, usage of which is defined as follows. In all cases, "n" is either 1 or 0, where 1 activates (locks) the command and 0 disables (unlocks) it.

$$PNn	Locks out all changes to the EEPROM when the jumper is installed. Any command attempting to change the EEPROM will fail, although the return will still report OK, as appropriate. The default is uninstalled.
$$PDn	Prevents the modem from dialing out. Causes the ATD command to fail to execute and report an error. Voice commands that try to produce touchtones will fail but report OK. The default is n=0 (disabled).
$$PAn	Locks out all AT commands. However, if S0 is set to a positive value, the modem will accept incoming data calls. The default is n=0 (disabled).
$$PI<x>	Resets the modem if <x> times 10 seconds elapse since the last AT commands. (See NOTE, below.) The module does a reset (ATZ) and restores its active profile to the settings stored in the EEPROM. The range of <x> is 1–255. $$PI255 disables the feature; $$PI0 is undefined and reserved. For example, if x is 6, the modem resets if sixty seconds elapses with no further AT command or connection. The default is x=255 (feature off).
$$PT<x>	Resets the modem <x> seconds after a connection is broken, unless a new connection occurs before <x> seconds, or unless a reset occurs for some other reason. (See NOTE, below.) The range of <x> is 0–255. $$PT255 turns the feature off; $$PT0 causes an immediate reset. This permits a user to make a new connection without losing an existing configuration that is different from the one stored in the EEPROM. This is particularly useful for use with dialback security. The default is n=255 (feature off).

$$PEn	Disables the escape sequence, even if the escape setting is mapped to a character string other than "+++". The default is n=0 (disabled).
$$PSn	Locks the value of S0. Commands that attempt to change the value of S0 will fail, but will report OK. The default is n=0 (disabled).
$$PQ	Reports the settings of all $$P commands and lock jumper status.

Examples:

```
PA0 PD1 PE0 PN0 PS1 PI006 PT020
JUMPER SET

PA1 PD0 PE1 PN1 PS0 PI255 PT001
JUMPER OFF
```

NOTE: If you use the AT$$PI or AT$$PT commands for resetting after inactivity or after a connection, you must first store the current terminal speed and parity by issuing the AT&W command. If you fail to do this, the modem reverts to its default speed and parity after a reset. This means the modem cannot answer any calls until you issue an AT, since the ring message is output at the wrong speed.

3 Problems and Solutions

Most problems can be solved by changing faxmodem settings with your communications software. If your faxmodem is not working properly, please read the communications software documentation first, and then this chapter. This chapter covers general, echo, dial, and on-line troubleshooting. It suggests AT commands you can use to change faxmodem settings from your software's terminal mode. (Refer to "Customizing Faxmodem Settings" in Chapter 2.)

NOTE: Many of the problems described here will occur if the security lock jumper is in place and some or all of the $$P security commands are activated. Before troubleshooting any problem, determine the status of this jumper. The jumper is described on page 12, and the security commands on page 23.

For help with this problem...	See page...
The faxmodem does not respond to AT commands.	26
The faxmodem stops working and no lights are on.	26
The faxmodem seems to connect to the remote modem, but nothing appears on your screen. Or, the faxmodem will not hang up reasonably quickly at the end of a call.	26
The faxmodem fails to execute the command line.	26
No response appears after executing a command.	27
You receive an ERROR response.	27
The faxmodem does not auto-answer.	27
You are uncertain about the DTR and DCD setting referred to in your software manual.	27
No characters appear on the screen during data mode.	28
No data characters appear on the screen during terminal mode.	28
The faxmodem can connect to some modems, but not to others.	29
You receive a CONNECT response, but no data characters appear on your screen.	31
The faxmodem disconnects while communicating with a remote system.	31
You receive bursts of errors occasionally, but otherwise data quality is good.	32
Random errors occur in transmitted data.	32

continued on the next page

For help with this problem...	See page...
Data is missing.	32
Data appears garbled on the screen.	32
The faxmodem works fine when you are not using data compression, but the compression (V.42bis and MNP5) features are inoperative.	33

General Troubleshooting

The faxmodem does not respond to AT commands. (The following comments apply to many other problems, as well.)

☐ The most common error with faxmodems is that the communications or fax software is not configured for the COM port connected to the faxmodem. Check which COM port the modem is connected to. Make sure that you have used the correct setting when configuring your software so that your communications and fax software match.

The faxmodem stops working completely and no lights (LEDs) are ON.

☐ Make sure the power switch on the rear of MultiLine is in the ON position.

☐ Make sure the fuse on the unit's motherboard (near the power switch) is OK.

☐ Make sure the power adapter is securely plugged into a working electrical outlet. You may want to plug another appliance (such as a lamp) into the AC outlet to make sure the outlet is working.

The faxmodem seems to connect to the remote modem, but nothing appears on your screen. Or, the faxmodem will not hang up reasonably quickly at the end of a call.

☐ Your faxmodem may not be receiving the required initialization string from your software. Make sure that your faxmodem is on **before** you start up your software.

You type an AT command and press Enter, but your faxmodem fails to execute the command line.

☐ Be sure you type **AT** at the beginning of the command line.

☐ Be sure your faxmodem is not in data mode when you type the command. Use the escape character sequence (default is +++) to switch to terminal mode.

☐ Make sure the communications software is configured for the COM port connected to your faxmodem. For example, if the faxmodem is plugged into COM2, the software should be configured for COM2.

No response appears after executing a command.

If you typed a command but did not receive an **OK** response from your faxmodem:

☐ The **E0** and **Q1** commands may be in effect, disabling echo and responses. Verify this with the **&V** command. To enable echo and responses type **AT E1 Q0** and press Enter.

☐ Be sure your faxmodem is in terminal mode and not in data mode when you type the command.

☐ Make sure the communications software and faxmodem are set for the same COM port.

You receive an ERROR response when trying to execute a command.

☐ Check whether you typed an unacceptable command.

☐ Be sure your command line contains fewer than 40 characters (including spaces).

Faxmodem does not auto-answer.

☐ Your faxmodem may not be configured to automatically answer incoming calls. If you want your fax or data software to answer calls, be sure you have selected this option in your software. (To set up auto-answer in AT terminal mode, type **AT S0=*n*** and press Enter, where ***n*** is the number of rings that you want to occur before the faxmodem auto-answers calls.)To save the setting so it is active the next time you use the software, type **AT S0=*n*&W**

You are uncertain about the Data Terminal Ready (DTR) and Data Carrier Detect (DCD) settings referred to in your software manual.

☐ If your software requires that your faxmodem ignore DTR (which is the faxmodem's default setting) and you are using the **&D2** command in the faxmodem's initialization string or have stored it in nonvolatile memory, your faxmodem will not work properly. If this is the case, store the **&D0** command in nonvolatile memory: Type **AT &D0 &W0 &Y0** and press Enter.

Also, make sure that your faxmodem initialization string does *not* contain **&D2**.

Conversely, if your software requires that your faxmodem *follow* DTR, the above considerations apply in reverse. If you are having problems, include **&D2** in the faxmodem initialization string.

☐ If your software requires that DCD always be forced ON and you are using the **&C1** command in the faxmodem initialization string or have stored it in nonvolatile memory, your faxmodem will not work properly. If this is the case, store the **&C0** command in nonvolatile memory: Type **AT &C0 &W0 &Y0** and press Enter.

Also, make sure that the faxmodem initialization string does ***not*** include **&C1**.

Conversely, if your software requires that Data Carrier Detect *follow* carrier, the above considerations apply in reverse. If you are having problems, include **&C1** in the faxmodem initialization string.

Echo Troubleshooting

No data characters appear on the screen during data mode.

☐ When you make a connection with a remote system and exchange data, the data will appear on your screen if you are in full-duplex operation. If you do not see the data, be sure the computer you are communicating with is operating full-duplex. Another cause may be that the remote system is waiting to receive your data before echoing it back to your system.

☐ If neither of these is the cause, other software on your computer may be affecting communications.

No data characters appear on screen during terminal mode.

☐ If you can't see the characters you are typing, type **AT E1** and press Enter.

☐ Make sure your network connection is correctly configured and working.

On-line Troubleshooting

The faxmodem can connect to some modems, but not to others.

☐ Your faxmodem negotiates the highest mutually compatible connection with a remote modem. However, when you are calling a remote modem that does not support data compression or error correction, this negotiation process may take too long or may result in incomprehensible characters reaching your faxmodem or the remote modem, causing one of them to break the connection. You may be able to solve this problem using an AT command string to disable the speed or protocol negotiation process or both. Refer to the table on the next page. Enter the command before you make the call or include the command string in the dial prefix for calling a particular modem.

☐ If a remote modem does not respond because of the extended negotiation process, you may have to disable part or all of the negotiation process.

To force changes in the negotiation process, use the following table. From terminal mode, type the required command in the dial string (for example: AT &Q5 N1 DT). In this table "protocol" means error correction and data compression. Note that the first two commands in the table are likely to be the most valuable.

NOTE:

In the command strings shown in the table that follows, the character after "N" is zero, not the letter "O."

To force...	Type these commands, and press Enter
Negotiate speed and protocol (default setting)	**AT &Q5 N1**
Negotiate speed only, do not use protocol	**AT &Q6 N1**
Connect at 28800 bps, negotiate protocol (V.34 module only)	**AT &Q5 +MS=11**

Connect at 28800 bps, no protocol (V.34 module only)	**AT &Q6 +MS=11**
Connect at 14400 bps, negotiate protocol	**AT &Q5 S37=11N0**
Connect at 14400 bps, no protocol	**AT &Q6 S37=11N0**
Connect at 9600 bps, negotiate protocol	**AT &Q5 S37=9N0**
Connect at 9600 bps, no protocol	**AT &Q6 S37=9N0**
Connect at 2400 bps, negotiate protocol	**AT &Q5 S37=6N0**
Connect at 2400 bps, no protocol	**AT &Q6 S37=6N0**
Connect at 1200 bps, negotiate protocol	**AT &Q5 S37=5N0**
Connect at 1200 bps, no protocol	**AT &Q6 S37=5N0**
Connect at 300 bps, no protocol	**AT &Q6 S37=1N0**

NOTE 1

You may find it necessary or helpful to include **S95=44** in your initialization string. This enables the responses **CARRIER** (telephone line speed) and **PROTOCOL**, as well as **CONNECT** (faxmodem-to-computer speed).

NOTE 2

Some software allows these commands to be added to the list of dial prefixes.

There are other configurations that can be forced, as well. If you need to select a particular configuration, use the AT command strings shown below. You can always return to the faxmodem's default configuration by typing **AT&F** and pressing the Enter key, but remember that if you do that, the faxmodem will not have received the commands in your software's initialization string, as it normally would. Using the ATZ command overcomes this problem if you have saved all of your setup parameters in nonvolatile memory.

To save setup parameters in nonvolatile memory in AT terminal mode: Type **AT**, followed by the parameter settings you choose, followed by **&W0** or **&W1**, and press Enter. For example, if you type **AT &C1 &D2 &W0** and press Enter, the **&C1** and **&D2** parameter settings are stored in Profile 0. (See Appendix B for the table of AT commands.)

To force...	**Type these commands, and press Enter**
MNP5/MNP4 operation	**AT \N5**
LAPM only	**AT %C0 S48=0**
MNP4 only	**AT \N5 %C0**
MNP10 operation	**)M1 –K1 –SEC=1**
"Normal" operation (The faxmodem will communicate without any error correction or data compression, but will retain speed buffering and auto-speed negotiation. It should not be confused with the "standard" configuration.)	**AT &Q6 N1**
Auto-answer	**AT S0=1**

You receive a CONNECT response, but no data characters appear on your computer screen.

☐ Be sure the remote computer is operating full-duplex.

☐ The remote system is waiting to receive your data before echoing it back to your system. Try pressing the Enter key several times.

☐ Other software or hardware on your computer is affecting communications.

Your faxmodem disconnects while communicating with a remote system.

☐ The remote system has hung up.

☐ Your computer or terminal (DTE) has turned off the Data Terminal Ready (DTR) signal to your faxmodem.

☐ The telephone line disrupted or disconnected your call. If your telephone service includes **Call Waiting**, you should turn it off, if possible, before making modem or fax calls. Check with your telephone company to find out if you can temporarily disable Call Waiting by pressing *70. If so, include this as a prefix with telephone numbers in your dialing directory. You can also use the dial string: **ATDT*70,** (**NOTE** Be sure to enter the ,)

You receive bursts of errors occasionally, but otherwise data quality is good.

☐ The connection may have been established on poor-quality or noisy telephone lines. Disconnect and place the call again to try and obtain a better connection.

☐ Someone may be picking up an extension connected to the line that your faxmodem is using. If the faxmodem is sharing a telephone line with other telephones, inform the other users when you will be making a data call.

☐ Your telephone line may have a Call Waiting feature and a call is being received. You can disable most Call Waiting features by adding a prefix to the telephone number when you type the faxmodem command. Contact your telephone company for more information.

Random errors occur in transmitted data or data is missing.

☐ Use the MNP or LAPM protocol if the remote modem supports one of these protocols.

☐ Reduce the baud rate.

☐ If both modems or faxmodems are using the MNP or V.42 protocol, the only way this can occur is if your faxmodem and communications software are not using the appropriate flow control.

☐ Configure your communications software for RTS/CTS flow control. This allows your computer to pause for the transmission to be stored.

Data appears garbled on the screen.

☐ Your communications software character setup (start bit, data bits, stop bits, and parity bit) does not match that of the remote system. Check your settings against those used by the remote system and make sure they match. Pay particular attention to the parity setting, as this is the most common difference among systems. You should normally use 8 data bits, NO parity, and 1 stop bit (8, NONE, 1). The second most common setting is 7 data bits, EVEN parity, and 1 stop bit (7, EVEN, 1).

☐ Poor telephone line conditions forced your faxmodem to fall back to a slower communications speed. To continue communications, change the speed of your software to match the current communications speed. To return to the original speed, disconnect and call again.

Your faxmodem works fine when you are not using data compression, but the compression (V.42bis and MNP5) features cause problems.

☐ Your software needs to use a streaming protocol, such as Ymodem-G or Zmodem. Xmodem and Ymodem are not adequate.

☐ Your software must be set up so that your faxmodem is using hardware flow control (RTS/CTS ON).

☐ You may use a computer-to-faxmodem speed of up to 115200 bps for V.34, 57,600 for V.32bis; set this for each entry in the dialing directory.

☐ Be aware that many download files that have already been compressed. In general, your faxmodem will not be able to further compress such files.

Appendix A: AT Commands

AT commands communicate directly with the modem when it is in terminal mode. This appendix is a quick reference for experienced modem users. **If you are not familiar with AT commands, we recommend that you use communications software rather than AT commands for all functions. Software is easier for most users.**

To summarize AT command syntax:

- Multiple commands can be strung together in one line.
- Command lines cannot exceed 40 upper- or lower-case characters. (Do not mix upper- and lower-case.) The modem ignores space characters.
- Command lines must start with AT and end with a carriage return (Return or Enter).
- A missing command parameter is assumed to be a zero. For example, ATH is the same as ATH0.
- **A/** on a line by itself without a carriage return causes the modem to repeat the previous command.

To switch to terminal mode from data mode, wait at least one second, type **+++** (the default escape characters), and wait at least one second before entering other characters. After the OK message from the modem, you can enter AT commands. To return to data mode, type **ATO** and press Return (or Enter).

Bold indicates the default setting. (Not all commands have defaults.)

Command	Function
A	Answers incoming call immediately.
B0	Uses V.22 connection at 1200 bps.
B1	**Uses Bell 212A connection at 1200 bps.**
D*n*	Dials telephone number *n*.
You can combine D with one or more of the following modifiers:	
L	Redials last number.
P	Uses pulse dialing.
T	Uses tone dialing.
W	Waits for dial tone.
,	Pauses during dial as specified in register S8 (default: 2 sec.).
@	Waits for at least 5 seconds of silence.
R	Command accepted but not acted upon.
;	Returns to terminal mode after dialing (put after dial string).
!	Goes on hook (time specified in S29).
S=*(0-3)*	Dial one of 4 numbers stored with &Z*n*.
^	Turn on calling tone (data only).

Command	Function
E0	Command characters not echoed.
E1	**Command characters echoed.**
H0	Forces modem to hang up.
H1	Forces modem off-hook.
I0	Returns 3-digit product code.
I1	Returns ROM checksum.
I2	Computes checksum, compares with value in ROM, and returns OK or ERROR.
I3	Returns firmware revision code.
I4	Returns modem identifier string.
I5	Returns country code.
I6	Returns data pump model and revision code.
L0	Lowest speaker volume (same as L1).
L1	**Low speaker volume.**
L2	Medium speaker volume.
L3	Highest speaker volume.
M0	Speaker always off.
M1	**Speaker on until carrier detected.**
M2	Speaker always on.
M3	Speaker on during answering only.
N0	Disables auto-mode (automatic modulation negotiation); uses connection speed specified in S37 (equivalent to +MS <*automode*> set to 0).
N1	**Enables auto-mode** (equivalent to +MS <*automode*> set to 1).
O0	Enters data mode.
O1	Enters data mode and retrains modem to phone line conditions.
P	Pulse dialing until T command.
Q0	**Enables responses to computer (DTE).**
Q1	Disables responses to computer.
S*n*	Establishes S-register *n* as the default register.
S*n*=*v*	Sets register *n* to value *v*.
S*n*?	Returns the value of register *n*.
T	**Tone dialing until P command.**
V0	Send numeric (short form) responses.
V1	**Send word (long form) responses.**

Command	**Function**
W0	**Reports DTE (computer-to-modem) speed only.**
W1	Reports DCE (modem-to-modem) speed, error correction protocol, and DTE speed.
W2	Reports DCE (modem-to-modem) speed only.
X0	Sends OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER.
X1	Sends X0 messages and CONNECT speed.
X2	Sends X1 messages and NO DIALTONE.
X3	Sends X2 messages and BUSY.
X4	**Sends all responses.**
Y0	**Disables long space disconnect.**
Y1	Enables long space disconnect; with error correction, hangs up after 1.6 second signal break; without error correction, sends 4 second space before hanging up.
Z0	Resets modem to profile 0. (See &W0.)
Z1	Resets modem to profile 1. (See &W1.)
&C0	Forces RLSD (DCD) on.
&C1	**RLSD (DCD) follows remote carrier.**
&D0	DTR is assumed on. Allows operation with DTEs that do not provide DTR signal.
&D1	Modem interprets DTR drop as if escape sequence was received. Returns to terminal mode without disconnecting.
&D2	**DTR drop causes modem to hang up. Auto-answer is inhibited.**
&D3	DTR drop causes modem to do soft reset. &Y setting determines which profile is loaded.
&F	Loads factory profile.
&G0	**Disables guard tone.**
&G1	Disables guard tone.
&G2	Enables 1800 Hz guard tone.
&K0	Disables flow control.
&K3	**Enables RTS/CTS (hardware) flow control.**
&K4	Enables XON/XOFF flow control.
&K5	XON/XOFF with passthrough.
&K6	Enables both RTS/CTS and XON/XOFF flow control.
&M0	Selects asynchronous mode (&Q0).
&P0	**Make/break dial ratio of 39/61 at 10 pps.**
&P1, &P2, &P3	Command accepted, but not acted upon.
&Q0	Selects direct asynchronous mode (no error correction or speed buffering).
&Q5	**Modem negotiates error-correcting connection.**
&Q6	Selects asynchronous mode with speed buffering (no error correction).

Command	Function
&S0	**Forces Data Set Ready (DSR) on continuously.**
&S1	DSR active after answer tone detected and inactive after carrier loss.
For engineering testing only	
&T0	Ends test in progress.
&T1	Starts local analog loopback test.
&T3	Starts local digital loopback test .
&T4	Responds to remote modem request for digital loopback.
&T5	**Ignores remote modem request for digital loopback.**
&T6	Requests remote digital loopback without self-test.
&T7	Same as &T6 with self-test.
&T8	Starts local analog loopback with self-test.
&V	Displays current and stored profiles, and stored numbers.
&W0	Saves active configuration as profile 0.
&W1	Saves active configuration as profile 1.
&Y0	**Modem uses profile 0 on powerup.** (See &W0.)
&Y1	Modem uses profile 1 on powerup. (See &W1.)
&Z*n*=*x*	Stores telephone number (up to 34 digits) *x* in nonvolatile memory location *n* (0-3).
%C0	Disable data compression.
%C1	Enable MNP5 compression.
%C2	Enable V.42bis compression.
%C3	**Enables both MNP5 and V.42bis compression.**
%E0	Disables line-quality monitoring and auto-retraining.
%E1	Enables monitoring and retraining.
%E2	**Enables monitoring and fallback/fall forward.**
%E3	Enables monitoring, retraining, and fast hang up.
%L	Reports received signal level in -dBm.
%Q	Reports line signal quality.
\A0	64-character maximum MNP block size.
\A1	**128-character maximum MNP block size.**
\A2	192-character maximum MNP block size.
\A3	256-character maximum MNP block size.
\B*n*	In non-error correction mode, transmits line break to remote modem in 100 ms units (1-9 with 3 as default).
\G0	**Disables XON/XOFF (modem-to-modem) flow control.**
\G1	Enables XON/XOFF (modem-to-modem) flow control.
\K*n*	Defines break type.

Command	**Function**
\N0	Normal data link with speed buffering; no error correction.
\N1	Selects serial interface; same as &Q0.
\N2	Selects reliable (error correction) mode.
\N3	**Selects auto-reliable mode.**
\N4	LAPM error correction only.
\N5	MNP error correction only.
\V0	**Single line connect messages are disabled and a single numeric result code is generated for CONNECT DTE (nonverbose mode).**
\V1	Single line connect messages in the following format: CONNECT <DTE SPEED></Modulation></Protocol></Compression></Line Speed> subject to the command settings V (Verbose) and Q (Quiet). Modulation =/V32 for V.32 or V.32bis modulations. =/VFC for V.FC™ modulations. =/V34 for V.34 modulations. =/Modulation omitted for all others. Protocol =/NONE for no protocol. =/ALT for Microcom Network Protocol. =/LAPM for LAP-M protocol. Compression =/Compression omitted if protocol in NONE. =/CLASS5 for Microcom MNP5 compression. =/V42BIS for V.42bis compression. Line Speed Asymmetric rates displayed as /rate:TX/rate:RX Symmetric rates displayed as single DCE rate.
-K0	**Disables V.42 LAPM to MNP10 EC conversion.**
-K1	Enables V.42 LAPM to MNP10 EC conversion.
-K2	Enables V.42 LAPM to MNP10 EC conversion; inhibits MNP. Extended Services initiation during V.42 LAPM answer mode detection.
-Q0	Disables MNP 10 EC fallback to 2400 bps.
-Q1	**Enables MNP 10 EC fallback to 2400 bps.**
-SEC0	**Disables cellular base site MNP10-EC capability.**
-SEC1	Enables cellular base site MNP10-EC capability.
:E0	Disables V.32 compromise equalizer.
:E1	**Enables V.32 compromise equalizer.**

Command	**Function**
+MS=<*mod*>[,[<*automode*>],<*min_rate*>],<*max_rate*>]]]] See **NOTE**	Selects modulation; optionally enables or disables automatic modulation negotiation with the remote modem; optionally sets minimum and/or maximum rates.

<*mod*>	Selects modulation:	Possible Rates (bps):
0	V.21	300
1	V.22	1200
2	V.22 bis	2400, 1200
3	V.23	1200
9	V.32	9600, 4800
10	V.32 bis	14400, 12000, 9600, 7200, 4800
11	V.34	28800, 26400, 24000, 19200, 16800, 14400, 12000, 9600, 7200, 4800, 2400
64	Bell 103	300
69	Bell 212	1200
74	V.FC	28800, 26400, 24000, 21600, 19200, 16800, 14400

[,[<*auto-mode*>]	Enables or disables automatic modulation negotiation with the remote modem.
0	Disables (Equivalent to N0 command).
1	Enables (Equivalent to N1 command).
[,[<*min-rate*>]	See "Possible Rates (bps)" above. Default: **300** bps.
[,[<*max-rate*>]	See "Possible Rates (bps)" above. Default: **28800** bps.

NOTE *Use a comma (,) to separate optional subparameters. For example:* +MS=11,1,300,28800 *(+MS command with the default settings). Subparameters that you do not enter remain at their current value.(Type a comma only to skip a subparameter or carriage return to skip the last subparameter) For example:* +MS=,0, <Enter> *disables auto mode and keeps all other settings at their current value.*

Command	**Function (these security commands are discussed in detail on page 23)**
$$PN	Locks out changes to the EEPROM.
$$PD	Prevents the modem from dialing out.
$$PA	Locks out all AT commands.
$$PI	Resets modem after a specified time since last AT command.
$$PT	Resets modem a specified time after connection is broken.
$$PE	Disables the escape sequence.
$$PS	Locks the value of S0.
$$PQ	Reports the settings of all $$P commands.

Voice Commands

MultiLine's 14.4 modules support the following voice commands in response to the AT#CLS=8 command, which sets the voice/audio mode. Commands marked with an asterisk (*) will function only in this mode. Others will be recognized in any mode (data, Class 1 fax, Class 2 fax, or voice/audio).

For greater detail in the functionality of the commands, see Section 7 of Rockwell publication 1048, Rev. 3 (January 9, 1996), "AT Commands for RC288ACx and RC144ACx Modem Families," and any Addenda.

Commands	Function (*voice mode only)
A	Answering in voice/audio mode.
D	Dial in voice/audio mode.
H	Hang up in voice/audio mode.
Z	Reset in voice/audio mode.
$$T0*	Trunk loop break to DLE-d translation off.
$$T1*	**Trunk loop break to DLE-d translation on. At loop break, sends DLE-d to the software.**
$$Z0*	**Disables loop current reporting (14.4 modules only).**
$$Z1*	Enables loop current reporting (14.4 modules only). Reports DLE-<192> when loop current disappears, DLE-<193> when current appears. $$T1 must be of for this to work.
$$F0*	Loop current cadence is not filtered.
$$F1*	**Loop current events are ignored for 1 second after appearance of current. If current is off after 1 second, a Loop Current Disappeared report is issued.**
#BDR=0	**Enables autobaud detection on the DTE interface**
#BDR=*n*	Forces baud rate for 1<*n*<48 (turns off autobaud), where the speed is defined as *n*×2400 bps. For example, if *n*=1, speed is 2400 bps; if *n*=48, speed is 115,200 bps.
#CID=0	**Disables Caller ID.**
#CID=1	Enables formatted Caller ID reporting with date in month/day, time, and 10-digit incoming phone number.
#CID=2	Enables unformatted hexidecimal Caller ID reporting.
#CLS=0	**Selects data mode.**
#CLS=1	Selects Class 1 fax mode.
#CLS=2	Selects Class 2 fax mode.
#CLS=8	Selects voice/audio mode.
#MDL?	Requests the model number or name of the modem.
#MFR?	Requests the modem manufacturer.
#REV?	Requests the revision level.

Commands	Function (*voice mode only)
#TL=*n**	Adjusts the transmit level of the data pump audio output, where *n*=0000–7FFF. **Default is 7FFF if local handset or speaker is selected, or 3F44 if phone line is selected.**
#VBQ?*	Requests the size of the voice transmit and receive buffers.
#VBS=*n**	Selects the degree of ADPCM compression, where *n*=2 or 4, or 8 (PCM) bits per sample. **The default is 4.**
#VBT=*n**	Defines the duration of tones generated by the D command, where *n*=0–40 tenths of a second (i.e., 0–4 seconds). **The default is 10 (one second).** If *n*=0, tone generation is disabled.
#VCI?*	Requests the compression method and raw bits/sample.
#VLS=0*	Selects a device to be routed through the modem. #VLS=0 is telephone line, the only mode supported by MultiLine.
#VRA=*n**	Sets "Ringback Goes Away" timer value, where *n*=0–255 tenths of a second (0–25.5 seconds). **Default is 70.** If *n*=0, the timer is turned off, and the dialing modem sends VCON and immediately enters Online Voice Command Mode.
#VRN=*n**	Sets "Ringback Never Came" timer, where *n*=0–255 tenths of a second (0–25.5 seconds). **Default is 100.** If *n*=0, the timer is turned off, and the dialing modem sends VCON and immediately enters Online Voice Command Mode.
#VRX*	Turns on the Voice Receive Mode. Requires a #VLS command to set the input source
#VSD=0*	**Disables Voice Receive Mode silence deletion. Provides no function other than command response compatibility.**
#VSD=1*	Enable Voice Receive Mode silence deletion. Provides no function other than command response compatibility.
#VSK=255*	Turns on the skid spare buffer space. Any number other than 255 returns an error.
#VSP=*n**	Turns on the silence period detection timer, where 1<*n*<255 tenths of a second (0–25.5 seconds). If *n*=0, the timer is turned off. **Default is #VSP=55.**
#VSR=7200*	**Selects 7200 Hz sampling rate (for ADPCM or PCM)**
#VSR=11025*	Selects 11.025 kHz sampling rate (for PCM only)
#VSS=*n**	Enables or disables silence detection tuner, where *n*=0–3. If *n*=0 (default), silence detection is disabled. Where 1<*n*<3, 1 is the least sensitive setting and 3 is the most sensitive setting.

<table>
<tr><th>Commands</th><th>Function (*voice mode only)</th></tr>
<tr><td>#VTD=i, j, k*</td><td>Queries and controls which types of tones can be detected and reported to DTE via shielded codes in Voice Transmit, Voice receive, and Online Voice Command modes, where i, j, and k are three ASCII hexadecimal bit maps. The default is 3F, 3F, 3F. The table below describes the desired capabilities.
<table>
<tr><th>Bit</th><th>Description</th></tr>
<tr><td>0</td><td>0=disable DTMF tone capability
1= enable DTMF tone capability[1]</td></tr>
<tr><td>1</td><td>0=disable V.25 1300 Hz calling tone capability
1=enable V.25 1300 Hz calling tone capability[1]</td></tr>
<tr><td>2</td><td>0=disable T.30 1100 Hz fax calling tone capability
1=enable T.30 1100 Hz fax calling tone capability[1]</td></tr>
<tr><td>3</td><td>0=disable V.25/T.30 2100 Hz answer tone capability
1=enable V.25/T.30 2100 Hz answer tone capability[1]</td></tr>
<tr><td>4</td><td>0=disable Bell 2225 Hz answer tone capability
1=enable Bell 2225 Hz answer tone capability[1]</td></tr>
<tr><td>5</td><td>0=disable call progress tone and cadence capability
1=enable call progress tone and cadence capability[1]</td></tr>
<tr><td>6–7</td><td>Reserved</td></tr>
<tr><td colspan="2">Notes: 1. The modem detects this tone/cadence, and reports it via a shielded code to the DTE.
2. Tone detection is only performed when the sampling rate is 7.2 kHz (see #VSR command).</td></tr>
</table></td></tr>
<tr><td>#VTM=0*
#VTM=10*</td><td>Disables timing mark placement
Enables the placement of <DLE><T> timing marks by the DCE in the data stream during ADPCM recording</td></tr>
<tr><td>#VTS=<i>n</i>*</td><td>Generates tone signals if (and only if) sampling rate is set to 7.2 kHz by the #VSR command; <i>n</i> takes the form of [x,y,z], {x,z}, or x, as described below:
<table>
<tr><td>[x,y,z]</td><td>x represents the first frequency (0 or 200–3000 Hz)
y represents the second frequency (0 or 200–3000 Hz)
z represents the duration (in 100 ms units)</td></tr>
<tr><td>{x,z}</td><td>x represents the DTMF digit (0–9, A–D, *, #)
z represents the duration (in 100 ms units)</td></tr>
<tr><td>x</td><td>x represents the DTMF digit (0–9, A–D, *, #), with the duration defined by #VBT</td></tr>
</table></td></tr>
<tr><td>#VTX*</td><td>Sends a voice file to the line, speaker, or handset, as established by the #VLS command.</td></tr>
<tr><td>#VGT<i>n</i>*</td><td>Sets the playback volume of the headphone and speaker outputs, where <i>n</i>=128–228. The default is <i>n</i>=153. A lower number indicated a lower volume level.</td></tr>
</table>

Appendix B: S Registers

This appendix summarizes S registers. You can change the setting of an S register using an AT command. For example, **ATS6=4**. The appendix assumes you are already familiar with how to reset S registers.

Register	Range/ Value	Default	Function
S0	0-255 rings	0	Number of rings to auto-answer
S1	0-255 rings	0	Counts incoming rings
S2	0-255 ASCII	43	Escape character
S3	0-127 ASCII	13	Carriage return character
S4	0-127 ASCII	10	Line feed character
S5	0-255 ASCII	8	Backspace character
S6	2-255 seconds	2	Dial tone wait time before blind dialing
S7	1-255 seconds	50	Remote carrier wait time
S8	0-255 seconds	2	Comma pause time
S9	1-255 100 ms	6	Carrier detect response time
S10	1-255 100 ms	14	Delay between carrier loss and hang up
S11	50-255 1 ms	95	Tone duration in DTMF dialing
S12	0-255 20 ms	50	Escape code guard time
S13			RESERVED
S14			BIT MAPPED OPTIONS
S15			RESERVED
S16			TEST MODE BIT MAPPED OPTIONS
S17			RESERVED
S18	0-255 seconds	0	Modem test timer
S19-20			RESERVED
S21			V.24 BIT MAPPED OPTIONS
S22			SPEAKER BIT MAPPED OPTIONS
S23			BIT MAPPED OPTIONS

Register	Range/ Value	Default	Function
S24	0-255 seconds	0	Sleep inactivity timer
S25	0-255 10 ms	5	Data Terminal Ready delay
S26	0-255 10 ms	1	RTS-to-CTS delay
S27			BIT MAPPED OPTIONS
S28			BIT MAPPED OPTIONS
S29	0-255 10 ms	70	Flash dial modifier time
S30	0-255 10 seconds	0 (disabled)	Inactivity time before hang up
S31			BIT MAPPED OPTIONS
S32	0-255 ASCII	17	XON character
S33	0-255 ASCII	19	XOFF character
S34-35			RESERVED
S36	0, 3, 4, 7	7	LAPM failure control
	0		Modem disconnects
	3		Modem stays on line and establishes a Normal mode (speed buffering) connection.
	4		Attempts MNP connection; if fails, disconnects
	7		Attempts MNP connection; if fails, establishes a Normal mode (speed buffering) connection.
S37	0-12	0	Desired DCE connection speed
	0		Attempt automode connection (F0)
	1-3		Attempt to connect at 300 bps (F1)
	4		Reserved
	5		Attempt to connect at 1200 bps (F4)
	6		Attempt to connect at 2400 bps (F5)
	7		Attempt to connect at 75 bps send/ 1200 bps receive V.23 (F3)
	8		Attempt to connect at 4800 bps (F6)
	9		Attempt to connect at 9600 bps (F8)

Register	Range/ Value	Default	Function
S37 *(cont.)*	10		Attempt to connect at 12000 bps (F9)
	11		Attempt to connect at 14000 bps (F10)
	12		Attempt to connect at 7200 bps (F7)
S38	0-255 seconds	20	Delay before forced disconnect
S39	0-6	3	FLOW CONTROL
	0		No flow control
	3		RTS/CTS (&K3)
	4		XON/XOFF
	5		Transparent XON (&K5)
	6		Both methods (&K6)
S40-41			BIT MAPPED OPTIONS
S42-45			RESERVED
S46	136 or 138	138	Data compression selection
	136		Error correction with no compression
	138		Error correction and compression
S48	0, 7, or 128	7	V.42 negotiation action
	0		No negotiation; bypass detection and negotiation phases; proceed with LAPM
	7		Negotiation
	128		No negotiation; bypass detection and negotiation phases; proceed with S36 fallback action
S80			RESERVED
S82	3, 7, or 128	128	Break handling options
	3		Break immediate; data integrity maintained ahead of and after break
	7		Break immediate; data at time of break destroyed
	128		Break in sequence with any transmitted data; data integrity maintained ahead of and after break

Register	Range/ Value	Default	Function
S86	0, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	none	Call failure reason code
	0		Normal disconnect, no error
	4		Loss of carrier
	5		V.42 negotiation failed to detect error correction modem at remote end
	6		No response to feature negotiation
	7		This modem is asynch only; remote modem is synch only
	8		No framing technique in common
	9		Modems could not find a common protocol
	10		Bad response to feature negotiation
	11		No synch information from remote modem
	12		Remote modem initiated a normal disconnect
	13		Remote modem does not respond after 10 message re-transmissions
	14		Protocol violation
S91	0–15 dBm	10 dBm	PSTN transmit attenuation level
S92	0–15 dBm	10 dBm	Fax transmit attenuation level
S95	Add numbers below for desired messages:	0	Extended result codes
	0		CONNECT gives computer-to-modem (DTE) speed
	1		CONNECT gives DCE speed
	2		/ARQ after CONNECT if error correction is active
	4		CARRIER message
	8		PROTOCOL message
	32		COMPRESSION message

Appendix C: Result Codes

The table of results codes below indicates the verification messages that the modem generates depending on the currently active X*n* option. The default setting is X4. To select short form messages, enter the command AT V0 . To select long form messages, enter the command AT V1 . The default setting is V1.

A check in a column indicates that the message is generated by the modem when you have chosen the value shown at the top of the column with ATX*n* command. If the column is blank, the modem does not generate a message for that X option. A “1” or “3” after a check mark indicates the less explicit message that the modem generates for that option. For example, if the modem is set for long form messages, the value of X*n* is X0, and the computer-to-modem speed is 1200 bps, the modem generates the message “CONNECT” and not “CONNECT 1200”.

Short	**Long**	***n* Value in ATX*n* Command**				
Form	**Form**	**0**	**1**	**2**	**3**	**4**
0	OK	✓	✓	✓	✓	✓
1	CONNECT	✓	✓	✓	✓	✓
2	RING	✓	✓	✓	✓	✓
3	NO CARRIER	✓	✓	✓	✓	✓
4	ERROR	✓	✓	✓	✓	✓
5	CONNECT 1200	✓1	✓	✓	✓	✓
6	NO DIALTONE	✓3	✓✓	✓	✓	✓
7	BUSY	✓3	✓✓	✓✓	✓	✓
8	NO ANSWER	✓	✓	✓	✓	✓
9	CONNECT 0600	✓1	✓	✓	✓	✓
10	CONNECT 2400	✓1	✓	✓	✓	✓
11	CONNECT 4800	✓1	✓	✓	✓	✓
12	CONNECT 9600	✓1	✓	✓	✓	✓
13	CONNECT 7200	✓1	✓	✓	✓	✓
14	CONNECT 12000	✓1	✓	✓	✓	✓
15	CONNECT 14400	✓1	✓	✓	✓	✓
16	CONNECT 19200	✓1	✓	✓	✓	✓
17	CONNECT 38400	✓1	✓	✓	✓	✓

Short	**Long**	***n* Value in ATX*n***				
Form	**Form**	**0**	**1**	**2**	**3**	**4**
18	CONNECT 57600	✓[1]	✓	✓	✓	✓
19	CONNECT 115200	✓[1]	✓	✓	✓	✓
22	CONNECT 75RX/1200TX	✓[1]	✓	✓	✓	✓
23	CONNECT 75TX/1200RX	✓[1]	✓	✓	✓	✓
24	DELAYED	✓	✓	✓	✓	✓
32	BLACKLISTED	✓	✓	✓	✓	✓
33	FAX	✓	✓	✓	✓	✓
34	+FC ERROR	✓	✓	✓	✓	✓
35	DATA	✓	✓	✓	✓	✓
40	CARRIER 300					✓
42	CARRIER 600					✓
44	CARRIER 1200/75					✓
45	CARRIER 75/1200					✓
46	CARRIER 1200					✓
47	CARRIER 2400					✓
48	CARRIER 4800					✓
49	CARRIER 7200					✓
50	CARRIER 9600					✓
51	CARRIER 12000					✓
52	CARRIER 14400					✓
53	CARRIER 16800					✓
54	CARRIER 19200					✓
55	CARRIER 21600					✓
56	CARRIER 24000					✓
57	CARRIER 26400					✓
58	CARRIER 28800					✓
59	CONNECT 16800	✓[1]	✓	✓	✓	✓
61	CONNECT 21600	✓[1]	✓	✓	✓	✓
62	CONNECT 24000	✓[1]	✓	✓	✓	✓
63	CONNECT 26400	✓[1]	✓	✓	✓	✓
64	CONNECT 28800	✓[1]	✓	✓	✓	✓
66	COMPRESSION: CLASS 5					✓

Short Form	Long Form	*n* Value in ATX*n* 0	1	2	3	4
67	COMPRESSION: V.42 bis					✓
69	COMPRESSION: NONE					✓
70	PROTOCOL: NONE					✓
77	PROTOCOL: LAPM					✓
80	PROTOCOL: ALT					✓
81	PROTOCOL: ALT - CELL	✓	✓	✓	✓	✓
82	DOWNLOAD INITIATED	✓	✓	✓	✓	✓
+F4	+FCERROR	❖	✓	✓	✓	✓

Appendix D: Product Specifications

Multiline supports the following standards, functions, and features:

Standards

- ***V.34 module***

  28,800/26,400/24,000/21,600/19,200/16,800/14,400 bps — V.34/V.FC

- ***V.34 and V.32bis modules***

  14,400/12,000/9600/7200/4800 bps — V.32bis

  9600/4800 bps — V.32

  2400 bps — V.22bis

  1200 bps — Bell 212A, V.22, V.22 A/B, V.23

  300 bps — Bell 103, V.21

- ***Fax encoding***

  Group 3 Fax, Class 1 (EIA/TIA 578) and Class 2 (EIA/TIA 592)

  14,400/12,000 bps — V.33, V.17

  9600/7200 — V.29, V.17

  4800/2400 bps — V.27 ter

  300 bps — V.21 Channel 2

- ***Flow Control***

  RTS/CTS, XON/XOFF, transparent XON,XOFF, modem-to-modem

- ***Terminal-to-modem (DTE) data rates, automatically sensed***

  115,200/57,600/38,400/19,200/14,400/9600/7200/4800/2400/1200/300

- ***"AT" Automatic speed sense data formats***

Parity	Data Length	Stop bits
Odd	7, 8	1
Even	7, 8	1
Mark	7	1
None	8	1

- ***Diagnostics***

  EIA TR30.2 (analog loopback, analog loop self-test, remote digital loopback, remote digital loopback with self-test, digital loopback)

- ***Operation***

  Full duplex over two-wire switched lines. Automatic or manual originate and answer modes.

- ***Equalization***

  Automatic adaptive equalization and gain control.

- ***Dialing Capability***

  DTMF (Touchtone) and pulse dial, programmable DTMF tone duration.

- ***Command Buffer***

  40 characters

- ***S Registers***

  S0–S12, S14, S16, S18, S21–S33, S36–S41, S46, S48, S82, S86, S91, S92, S95.

- ***Nonvolatile Storage***

  Commands stored: B E L M N P or T Q V W X Y
  &C &D &G &J &K &P &Q &R &S &T &Y %C %E \A \K \N
  \V +MS -K -SEC $$PN $$PD $$PA $$PI $$PT $$PE $$PS $$PQ
  S Registers stored: S0, S2, S6–S12, S14, S18, S21–S23, S24, S27, S31, S36, S37, S39, S40, S41, S46, S48, S95

- ***MNP Commands***

  %C &Q5 W \A \B \K \N

- ***MNP S Registers***

  S36, S38, S40, S41, S46

- ***V.42 Registers***

  S36, S38, S41, S46, S48, S86

- ***Audio Monitor***

  One high-efficiency transducer for all lines

- ***Size***

  7.75" × 10.73" × 1.79"

Configuration

Four or eight faxmodem modules standard; supports up to 8 plug-in modules in any combination.

Power Supply

Single power connector with in-line switching power supply; 40W input (to the power supply) typical maximum with 8 V.34 modules active; +5V, –12VDC and +12VDC output.

Terminal Interface

CCITT V.24 (EIA-232-D) compatible; female RJ-45 connectors.

Physical Specifications

Faxmodem (per module):

Configuration	Faxmodem with three status lights and reset button. Audio speaker combines audio from all modules.
Jacks	EIA-232-D, RJ-45 female RJ-11 telephone
Size	3.62" × 1.45" × 0.50"

Electrical Specifications:

Power Adapter Input	100 to 250 VAC, 50–60 Hz., 1.2A
Power Adapter Output	40W input typical maximum with 8 V.34 modules active; +5V, –12VDC, +12VDC. Use only the power adapter provided.

Performance Specifications:

Transmit Signal Level (Nominal)	–10 ± 1 dBm
Transmit Frequency Tolerance	± 0.01 percent
Receive Signal Level	–9 dBm to –43 dBm
Carrier Detect Levels	ON –43 dBm OFF –48 dBm
Receive Frequency Tolerance	±7 Hz

Environmental Specifications:

Operating Temperature	0°C to 40°C
Operating humidity	95% noncondensing
Power rating	24W maximum dissipation
Thermal restrictions	Maintain at least 1" air space on both sides of the unit. Place no obstructions on the top of the cabinet to ensure proper cooling.

Appendix E: Regulatory Information

FCC Part 68 Telecommunications Statement

The Federal Communications Commission (FCC) has established Rules which permit this device to be directly connected to the telephone network. This device is registered with the Federal Communications Commission (FCC) for direct connection to the telephone line using a standardized RJ11C telephone jack. This device complies with the Part 15, Subpart B, and Part 68 requirements of the FCC rules.

The telephone company may make changes in its technical operations and procedures; if such changes affect the compatibility or use of the device, the telephone company is required to give adequate notice of the changes.

If the telephone company requests information on what equipment is connected to the line, inform them of:

a) *The telephone number that this unit is connected to,*

b) *The ringer equivalence number [0.8B],*

c) *The USOC jack required [RJ11C], and*

d) *The FCC Registration Number.*

Items (b) and (d) are indicated on the label attached to the bottom of the device. The ringer equivalence number is used to determine how many how many devices can be connected to your telephone line. In most cases, the sum of the RENs of all devices on nay one line should not exceed five (5.0). If too many devices are attached, they may not ring properly.

If this device should malfunction, it may also cause harm to the telephone network; Should this occur, this device should be disconnected from the network until the source of the problem can be determined and repair has been made. If a device which harms the network is not removed, the telephone company may temporarily disconnect service.

In the event of equipment malfunction, all repairs should be performed at an authorized repair facility. It is the responsibility of users requiring service to report the need for service to such a facility. Service facilities are listed on the product's warranty card.

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via telephone fax machine unless such message clearly contains in a margin at the top or bottom of each transmitted page, or on the first page of the transmission, the date and time sent, the identification of the business, entity, or individual sending the message, and the telephone number of the sending machine. In order to program this information into your fax machine, refer to your faxmodem software documentation for information on enabling fax branding.

FCC Part 15 Emissions Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Industry Canada Attachment

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telephone company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. For locations of the authorized service facilities, please see the product's warranty card. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electrical inspection authority, or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all devices does not exceed 100.

Canadian Emissions Statement

This Class A digital apparatus all requirements meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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